UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

QUANERGY SYSTEMS, INC.,

Plaintiff,

v.

VELODYNE LIDAR, INC.,

Defendant.

Case No. 16-cv-05251-EJD

CLAIM CONSTRUCTION ORDER

Re: Dkt. No. 68

Plaintiff Quanergy Systems, Inc. ("Quanergy") initiated this lawsuit against Defendant Velodyne Lidar, Inc. ("Velodyne") seeking, among other things, declaratory judgment that it does not infringe U.S. Patent No. 7,969,558 ("the '558 patent"). Dkt. No. 35. In response, Velodyne counterclaimed that Quanergy infringed the '558 patent. Dkt. No. 37. The parties dispute the proper construction of ten terms used in the claims of the '558 patent. The Court held a technology tutorial and claim construction hearing on September 13, 2017. Upon consideration of the claims, specification, prosecution history, and other relevant evidence, and after hearing the arguments of the parties, the Court construes the contested language of the patents-in-suit as set forth below.

I. TECHNOLOGY BACKGROUND

The '558 patent, titled "High Definition Lidar System," was filed on July 13, 2007 and issued on June 28, 2011. It claims priority to a provisional application which was filed on July 13, 2006.

The '558 patent generally relates to "[a] lidar-based 3-D point cloud measuring system and

method." '558 patent, Abstract. Laser Imaging Detection and Ranging or "LiDAR" is a technology that uses a pulse of light to measure distance. '558 patent, 1:11–14. A laser emitter sends a pulse of light, a detector detects when that pulse of light returns, and the time elapsed is used to calculate distance. *Id.*, 1:13–18. "When multiple pulses are emitted in rapid succession, and the direction of those emissions is somehow sequentially varied," the resulting collection of data points or "pixels" forms a 3-D "point cloud" which can provide information in three dimensions about the closeness of surrounding objects. *Id.*, 1:20–31.

According to the '558 patent, "3-D point cloud systems exist in several configurations" in the prior art. *Id.*, 2:35–36. However, "the needs for autonomous vehicle navigation place unrealistic demands on current systems." *Id.*, 2:36–37. To address these needs, the '558 patent discloses a system which "performs at a frame rate that permits high-speed navigation, provides recognition of both positive and negative obstacles, provides exceptional point cloud density, provides full 360 degree HFOV, provides broad VFOV, and provides high accuracy rates." *Id.*, 6:37–41; *see also id.*, 4:11–13.. Figures 5 and 6 illustrate an exemplary system:

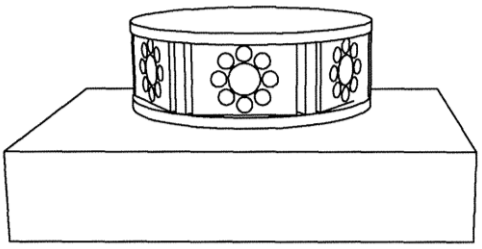

FIG.5

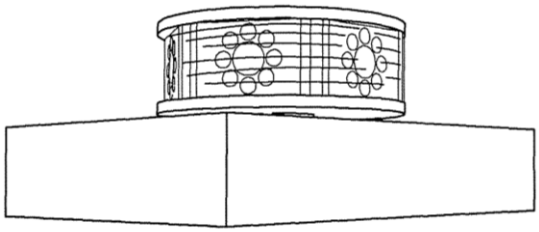

FIG.6

Id., Figs. 5, 6. This system comprises a housing mounted on a base which contains a "plurality of photon transmitters and photon detectors." *Id.*, 3:4–5. A "rotary motor" rotates the housing about the base, allowing the photon transmitters and photon detectors to capture the distances of surrounding objects in 360 degrees. *Id.*, 4:3–6. The housing "rotates at a rate of up to 200Hz, thereby providing a high point cloud refresh rate, such high rate being necessary for autonomous navigation at higher speeds." *Id.*, 4:7–9. The system also includes a "communication component

that allows transmission of signals generated by the photon detectors to the external components." *Id.*, 3:7–9.

Independent claim 1 is exemplary and recites:

> 1. A lidar-based 3-D point cloud system comprising:
> a support structure;
> a plurality of laser emitters supported by the support structure;
> a plurality of avalanche photodiode detectors supported by the support structure; and
> a rotary component configured to rotate the plurality of laser emitters and the plurality of avalanche photodiode detectors at a speed of at least 200 RPM.

Id., 7:59–67.

II. LEGAL STANDARDS

A. Claim Construction

Claim construction is a question of law to be decided by the court. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc), *aff'd* 517 U.S. 370, 116 S. Ct. 1384, 134 L. Ed. 2d 577 (1996). "[T]he interpretation to be given a term can only be determined and confirmed with a full understanding of what the inventors actually invented and intended to envelop with the claim." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1316 (Fed. Cir. 2005) (quoting *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1250 (Fed. Cir. 1998)). Consequently, the court construes claims in the manner that "most naturally aligns with the patent's description of the invention." *Id.*

In construing disputed terms, the court looks first to the claims themselves, for "[i]t is a 'bedrock principle' of patent law that 'the claims of a patent define the invention to which the patentee is entitled the right to exclude.'" *Phillips*, 415 F.3d at 1312 (internal quotation marks omitted). Generally, the words of a claim should be given their "ordinary and customary meaning," which is "the meaning that the term[s] would have to a person of ordinary skill in the art in question at the time of the invention." *Id.* at 1312–13. In some instances, the ordinary meaning to a person of skill in the art is clear, and claim construction may involve "little more than the application of the widely accepted meaning of commonly understood words." *Id.* at 1314.

In many cases, however, the meaning of a term to a person skilled in the art will not be readily apparent, and the court must look to other sources to determine the term's meaning. *Id*. Under these circumstances, the court should consider the context in which the term is used in an asserted claim or in related claims, bearing in mind that "the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification." *Id*. at 1313. Indeed, the specification is "always highly relevant" and "[u]sually dispositive; it is the single best guide to the meaning of a disputed term." *Id*. at 1315 (internal quotation marks and citation omitted).

The court may also consider the patent's prosecution history, which consists of the complete record of proceedings before the United States Patent and Trademark Office and includes the cited prior art references. The prosecution history "can often inform the meaning of the claim language by demonstrating how the inventor understood the invention and whether the inventor limited the invention in the course of prosecution, making the claim scope narrower than it otherwise would be." *Id*. at 1317 (internal citations omitted).

Finally, the court is also authorized to consider extrinsic evidence in construing claims, such as "expert and inventor testimony, dictionaries, and learned treatises." *Markman*, 52 F.3d at 980 (internal citations omitted). Although the court may consider evidence extrinsic to the patent and prosecution history, such evidence is considered "less significant than the intrinsic record" and "less reliable than the patent and its prosecution history in determining how to read claim terms." *Id*. at 1317–18 (internal quotation marks and citation omitted). Thus, while extrinsic evidence may be useful in claim construction, ultimately "it is unlikely to result in a reliable interpretation of patent claim scope unless considered in the context of the intrinsic evidence." *Id*. at 1319.

B. Indefiniteness

Section 112 requires that "[t]he specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint

inventor regards as the invention." 35 U.S.C. § 112, ¶ 2.[1] In *Nautilus, Inc. v. Biosig Instruments, Inc.*, the Supreme Court established the operative test: "a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." —— U.S. ——, 134 S. Ct. 2120, 2128–29, 189 L. Ed. 2d 37 (2014). The Federal Circuit has cautioned that "the dispositive question in an indefiniteness inquiry is whether the 'claims,' not particular claim terms" fail this test. *Cox Commc'ns, Inc. v. Sprint Commc'n Co. LP*, 838 F.3d 1224, 1231 (Fed. Cir. 2016). For that reason, a claim term that "does not discernably alter the scope of the claims" may fail to serve as a source of indefiniteness. *Id.*

C. Means-Plus-Function Claiming

The Patent Act authorizes functional claiming: "[a]n element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof." 35 U.S.C. § 112, ¶ 6.[2] "In enacting this provision, Congress struck a balance in allowing patentees to express a claim limitation by reciting a function to be performed rather than by reciting structure for performing that function, while placing specific constraints on how such a limitation is to be construed, namely, by restricting the scope of coverage to only the structure, materials, or acts described in the specification as corresponding to the claimed function and equivalents thereof." *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1347 (Fed. Cir. 2015) (en banc). Thus, "if one employs means-plus-function language in a claim, one must set forth in the specification an adequate disclosure showing what is meant by that language." *Blackboard, Inc. v. Desire2Learn, Inc.*, 574 F.3d 1371, 1382 (Fed. Cir. 2009) (internal quotation marks omitted). "If

[1] The America Invents Act ("AIA"), Pub. L. No. 112–29, effective September 16, 2012, changed the designation of 35 U.S.C. 112, ¶ 2 to 35 U.S.C. 112(b). Because the asserted patents were filed before the effective date of the AIA, the Court refers to the pre-AIA versions of this provision.
[2] The AIA changed the designation of 35 U.S.C. 112, ¶ 6 to 35 U.S.C. 112(f). Because the asserted patents were filed before the effective date of the AIA, the Court refers to the pre-AIA versions of this provision.

the specification does not contain an adequate disclosure of the structure that corresponds to the claimed function, the patentee will have failed to particularly point out and distinctly claim the invention as required by the second paragraph of §112, which renders the claim invalid for indefiniteness." *Id*. (internal quotation marks omitted).

To determine whether a purportedly means-plus-function term is indefinite, the court employs a two-step process. First, the court determines whether the term-in-question is a means-plus-function term. "[T]he use of the word 'means' in a claim element creates a rebuttable presumption that § 112, ¶ 6 applies." *Id*. at 1348. Conversely, "the failure to use the word 'means' . . . creates a rebuttable presumption . . . that § 112, ¶ 6 does not apply." *Id*. However, "when a claim term lacks the word 'means,' the presumption can be overcome and § 112, ¶ 6 will apply if the challenger demonstrates that the claim term fails to 'recite[] sufficiently definite structure' or else recites 'function without reciting sufficient structure for performing that function.'" *Williamson*, 792 F.3d at 1348 (quoting *Watts v. XL Svs., Inc.*, 232 F.3d 877, 880 (Fed. Cir. 2000)). "In undertaking this analysis, [the court] ask[s] if the claim language, read in light of the specification, recites sufficiently definite structure to avoid § 112, ¶ 6." *Media Rights Techs., Inc. v. Capital One Fin. Corp.*, 800 F.3d 1366, 1372 (Fed. Cir. 2015), *cert. denied sub nom. Media Rights Techs., Inc. v. Capitol One Fin. Corp.*, 136 S. Ct. 1173, 194 L. Ed. 2d 178 (2016) (internal quotation marks and citation omitted).

Once a court determines that a claim term is a means-plus-function term, the court "next determine[s] whether the specification discloses sufficient structure that corresponds to the claimed function." *Williamson*, 792 F.3d at 1351. This, in turn, is a two-step process:

> The court must first identify the claimed function. Then, the court must determine what structure, if any, disclosed in the specification corresponds to the claimed function. Where there are multiple claimed functions, . . . the patentee must disclose adequate corresponding structure to perform all of the claimed functions. If the patentee fails to disclose adequate corresponding structure, the claim is indefinite.

Id. at 1351–52 (internal citation omitted).

When a defendant challenges a means-plus-function term as indefinite, indefiniteness must be proven by "clear and convincing evidence." *Microsoft Corp. v. i4i Ltd. Partnership*, 564 U.S.

91, 102 (2011). However, "[i]n determining whether [the] presumption [based on the lack of the word 'means'] has been rebutted, the challenger must [only] establish by a preponderance of the evidence that the claims are to be governed by § 112, ¶ 6." *Advanced Ground Info. Svs., Inc. v. Life360, Inc*., 830 F.3d 1341, 1347 (Fed. Cir. 2016).

III. CONSTRUCTION OF DISPUTED TERMS

A. The Preambles: "A lidar-based 3-D point cloud system" (claim 1) and "A method of generating a 3-D point cloud" (claim 19)

Velodyne's Proposed Construction	Quanergy's Proposed Construction	Court's Construction
Preamble is limiting	Preamble is not limiting	Preamble is limiting

The parties disagree as to whether the preambles of the independent claims (claims 1 and 19) of the '558 patent are limiting. Velodyne argues that the preambles are limiting because they are necessary to understand the subject matter and structural context of the claims. Opening Br. 5–7. According to Velodyne, the essence of the patent is a LiDAR-based system for generating 3-D point clouds, and only the preambles recite "LiDAR" and "3-D point clouds." *Id*. Velodyne also contends that it relied on the preambles to distinguish prior art during prosecution. *Id*. at 6–7.

Quanergy argues that the preambles are not limiting because the bodies of the claims describe a structurally complete invention and the preambles merely recite intended uses. Responsive Br. 2–9. Quanergy points out that the inventions in the claims could be used for purposes other than as a LiDAR system to generate 3-D point clouds, such as generating panoramic 2-D images under conditions of limited visibility. *Id*. at 4. Quanergy also disagrees that the preambles were relied on during prosecution to distinguish prior art. *Id*. at 5–6.

The Federal Circuit "has recognized that as a general rule preamble language is not treated as limiting." *Aspex Eyewear, Inc. v. Marchon Eyewear, Inc.*, 672 F.3d 1335, 1347 (Fed. Cir. 2012). Whether certain preamble language falls outside this rule (i.e., should be treated as limiting) is effectively a claim construction question, "resolved only on review of the entire[] . . . patent to gain an understanding of what the inventors actually invented and intended to encompass by the claim." *Catalina Mktg. Int'l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 808 (Fed. Cir.

2002) (internal citations omitted). Unfortunately, "[n]o litmus test defines when a preamble limits claim scope." *Id*. However, the Federal Circuit has offered the following guideposts:

> In general, a preamble limits the invention if it recites essential structure or steps, or if it is "necessary to give life, meaning, and vitality" to the claim. Conversely, a preamble is not limiting "where a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention." . . .
>
> [D]ependence on a particular disputed preamble phrase for antecedent basis may limit claim scope because it indicates a reliance on both the preamble and claim body to define the claimed invention. . . .
>
> [W]hen the preamble is essential to understand limitations or terms in the claim body, the preamble limits claim scope.
>
> [W]hen reciting additional structure or steps underscored as important by the specification, the preamble may operate as a claim limitation.
>
> [C]lear reliance on the preamble during prosecution to distinguish the claimed invention from the prior art transforms the preamble into a claim limitation because such reliance indicates use of the preamble to define, in part, the claimed invention. Without such reliance, however, a preamble generally is not limiting when the claim body describes a structurally complete invention such that deletion of the preamble phrase does not affect the structure or steps of the claimed invention. Thus, preamble language merely extolling benefits or features of the claimed invention does not limit the claim scope without clear reliance on those benefits or features as patentably significant.
>
> [S]tatements of intended use or asserted benefits in the preamble may, in rare instances, limit apparatus claims, but only if the applicant clearly and unmistakably relied on those uses or benefits to distinguish prior art.

Id. at 808–09 (internal citations omitted); *see also Georgetown Rail Equip. Co. v. Holland L.P.*, 867 F.3d 1229, 1236 (Fed. Cir. 2017) (summarizing guideposts from prior decisions).

Applying these principles here, the Court agrees with Velodyne that the preambles are limiting. Although "[w]ords of a claim are generally given their ordinary and customary meaning," this is not a meaning in a vacuum. *Phillips*, 415 F.3d at 1312 (internal quotation marks and citation omitted). Instead, this is "the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention," who, importantly, is "deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification." *Id*. at 1312, 1313. Ultimately, the "construction that stays true to the claim language and most naturally aligns with

the patent's description of the invention will be, in the end, the correct construction." *Trustees of Columbia Univ. in City of N.Y. v. Symantec Corp.*, 811 F.3d 1359, 1366 (Fed. Cir. 2016) (quoting *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1250 (Fed. Cir. 1998)).

Reading claims 1 and 19 in the context of the entire '558 patent, it is clear that the inventors intended the claims to be limited to "LiDAR" and "3-D point cloud" generation systems. The patent's title is "High Definition *Lidar* System." '558 patent, Title (emphasis added). The first sentence of its Abstract reads "[a] *lidar-based 3-D point cloud* measuring system and method." *Id*., Abstract (emphasis added). In the Summary of the Invention section, the specification states that *"[t]he present invention* provides a *lidar-based 3-D point cloud* measuring system." *Id*., 3:3–4 (emphasis added). It also states in this section that "*[t]he present invention* provides a more compact and rugged unit for gathering *3-D point cloud* information." *Id*., 3:28–29. In the Background section, the specification focuses almost exclusively on the limitations of prior art *LiDAR* systems to generate *3-D point clouds* that were sufficient for use in autonomous vehicles. *See id*., 1:45–2:60. In the Detailed Description section, the specification only discloses embodiments of LiDAR-based 3-D point cloud systems—in both the text and figures. *See id*., 3:65–7:56, Figs. 4–26. It also several times summarizes the advantages of the invention in ways which focus on LiDAR-based 3-D point cloud generation. *See, e.g., id*., 4:11–13 ("The system provides the unique combination of *360 degree FOV, high point cloud density*, and high refresh rate.") (emphasis added); *id*., 6:37–41 ("*The present invention* performs at a frame rate that permits high-speed navigation, provides recognition of both positive and negative obstacles, provides *exceptional point cloud density*, provides *full 360 degree HFOV*, provides *broad VFOV*, and provides high accuracy rates.") (emphasis added).

With such a consistent and exclusive focus on LiDAR-based 3-D point cloud systems, the context of the patent makes clear here that the inventors intended to limit the claims to these types of systems. *See GPNE Corp. v. Apple Inc.*, 830 F.3d 1365, 1370 (Fed. Cir. 2016) ("[W]hen a patent "repeatedly and consistently" characterizes a claim term in a particular way, it is proper to construe the claim term in accordance with that characterization."). In addition, use of the phrase

"the present invention" gives additional strength to the argument that the inventors intended the invention to be limited to "LiDAR" and "3-D point cloud" generation systems as "an inventor may disavow claims lacking a particular feature when the specification describes 'the present invention' as having that feature." *Poly-Am., L.P. v. API Indus., Inc.*, 839 F.3d 1131, 1136 (Fed. Cir. 2016), *cert. denied*, 137 S. Ct. 2267 (2017). Indeed, the Federal Circuit has narrowed the scope of claims under similar circumstances. *See, e.g.*, *id*. (construing the "short seals" of a trash bag to require a narrowed opening where the specification consistently disclosed embodiments with narrowed openings, described narrowed openings as a feature of "the present invention," and disparaged prior art solutions which did not have narrowed openings); *GPNE*, 830 F.3d at 1370 (construing "node" as a type of "pager" where the specification "repeatedly and exclusively" used "pager" or "pager unit" to describe such devices).

Thus, because the claims, properly construed, should be limited to "LiDAR" and "3-D point cloud" generation systems, the preamble—the only portion of the claims in which these words appear—does not merely "state a purpose or intended use" for a "structurally complete invention in the claim body." *Catalina Mktg.*, 289 F.3d at 808. Instead, the preamble "give[s] 'life and meaning' and provide[s] further positive limitations to the invention claimed." *Corning Glass Works v. Sumitomo Elec. U.S.A., Inc.*, 868 F.2d 1251, 1257 (Fed. Cir. 1989). Without the preamble, the claims do little more than recite a spinning structure with laser emitters and detectors. Only the preamble brings this arrangement into focus, such that it is consistent with the context of the specification. *Cf. Philips*, 415 F.3d at 1320 ("[T]he specification is always highly relevant to the claim construction analysis" and is "the single best guide to the meaning of a disputed term."). As such, the preamble must necessarily be limiting.

Quanergy nevertheless argues that the preamble is not limiting because the claims fall within the line of cases "where a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention." *Catalina Mktg.*, 289 F.3d at 808. The Court acknowledges that, when framed in this way, the claims present a close call—in a sense, "LiDAR-based" is already reflected in the "laser emitters" and

"avalanche photodiode detectors" elements and "3-D point cloud" describes the data set that the structure recited in the claims is used to generate. However, this oversimplifies the impact of the preamble on the claims. When "LiDAR" and "3-D point cloud" are read in conjunction with the rest of the claim language, these phrases provide additional structural detail to the body of the claims. Specifically, they require that the "laser emitters" and the "avalanche photodiode detectors" be connected and interact in such a way that the system is a "LiDAR" system (e.g., one where the emitters and detectors are used to measure distance, among other attributes) which is sufficient to generate a "3-D point cloud." In this sense, the claims present a similar situation to what confronted the Federal Circuit in *Deere & Co. v. Bush Hog, LLC*, 703 F.3d 1349 (Fed. Cir. 2012). There too the preamble, which recited "[a] rotary cutter deck," introduced additional structural detail because it "inform[ed] the meaning of the 'torsional stiffness' limitation—the claimed structure must possess sufficient stiffness to withstand the torsional loads imposed by the operation of a rotary cutter." *Id*. at 1358. For this and additional reasons, the Federal Circuit found the preamble limiting. *Id*. The claims here require the same conclusion.

In sum, "LiDAR" and "3-D point cloud" are "necessary to give life, meaning, and vitality" to the claims. *Catalina Mktg.*, 289 F.3d at 808. Thus, the preambles of claims 1 and 19 are limiting.

B. "Rotary component" (claims 1, 8, and 19)

Velodyne's Proposed Construction	Quanergy's Proposed Construction	Court's Construction
This term is governed by 35 U.S.C. § 112 ¶ 6. Claims 1 and 19: Function: rotating the plurality of laser emitters and the plurality of avalanche photodiode detectors at a speed of at least 200 RPM. Corresponding structure: a motor and equivalents.	Indefinite. To the extent this term is found to not be indefinite, this term is governed by 35 U.S.C. § 112 ¶ 6 (pre-AIA), and should be construed as follows: Claims 1 and 19: Function: rotating the plurality of laser emitters and	This term is governed by 35 U.S.C. § 112 ¶ 6. Claims 1 and 19: Function: rotating the plurality of laser emitters and the plurality of avalanche photodiode detectors at a speed of at least 200 RPM. Corresponding structure: (1) the "brushed motor" which is "driv[en]" by "[a] simple DC

Claim 8: Function: rotating the support structure through a full 360 degree rotation at the rotation speed of at least 200 RPM. Corresponding structure: a motor and equivalents.	the plurality of avalanche photodiode detectors at a speed of at least 200 RPM for a full 360 degrees or back and forth for less than 360 degree rotation. Corresponding structure: a DC motor controller driving a high reliability brushed motor to rotate at a speed of at least 200 RPM for a full 360 degree rotation and an undisclosed structure for less than 360 degree rotation. Claim 8: Function: rotating the support structure through a full 360 degree rotation at the rotation speed of at least 200 RPM. Corresponding structure: a DC motor controller driving a high reliability brushed motor.	motor controller," '558 patent, 5:39–40; (2) the "spin motor," *id*., Fig. 9A; (3) "[t]he magnetic rotor and stator," *id*., 6:61; and (4) equivalents. Claim 8: Function: rotating the support structure through a full 360 degree rotation at the rotation speed of at least 200 RPM. Corresponding structure: (1) the "brushed motor" which is "driv[en]" by "[a] simple DC motor controller," '558 patent, 5:39–40; (2) the "spin motor," *id*., Fig. 9A; (3) "[t]he magnetic rotor and stator," *id*., 6:61; and (4) equivalents.

The term "rotary component" appears in claims 1, 8, and 19. These claims recite:

1. A lidar-based 3-D point cloud system comprising:
a support structure;
a plurality of laser emitters supported by the support structure;
a plurality of avalanche photodiode detectors supported by the support structure; and
a *rotary component* configured to rotate the plurality of laser emitters and the plurality of avalanche photodiode detectors at a speed of at least 200 RPM.

8. The system of claim 1, wherein the *rotary component* is configured to rotate the support structure through a full 360 degree rotation at the rotation speed of at least 200 RPM.

19. A method of generating a 3-D point cloud comprising:
providing a lidar system having:
a support structure, a plurality of laser emitters supported by the support structure;
a plurality of avalanche photodiode detectors supported by the support structure, and a *rotary component* configured to rotate the plurality of laser emitters and the
plurality of avalanche photodiode detectors at a speed of at least 200 RPM;
rotating the plurality of laser emitters and the plurality of avalanche photodiode detectors at a speed of at least 200 RPM; and
emitting light from the plurality of laser emitters.

'558 patent, 7:59–67, 8:30–32, 9:6–17 (emphasis added).

The parties agree that the term "rotary component" is subject to § 112, ¶ 6. With respect to claims 1 and 19, the parties dispute the claimed function and corresponding structure. With respect to claim 8, the parties agree on the function but dispute the corresponding structure. The Court will first address the disputed function of claims 1 and 19, and then turn to the disputed corresponding structure of claims 1, 8, and 19.

i. Claims 1 and 19: Function

Velodyne argues that the function of claims 1 and 19 is simply the phrase that appears in the claims: "rotat[e/ing] the plurality of laser emitters and the plurality of avalanche photodiode detectors at a speed of at least 200 RPM." Opening Br. 7–8. Velodyne argues that Quanergy's proposed additions to the claim language violate Federal Circuit law that "a court may not construe a means-plus-function limitation by adopting a function different from that explicitly recited in the claim." *JVW Enterprises, Inc. v. Interact Accessories, Inc.*, 424 F.3d 1324, 1331 (Fed. Cir. 2005). Velodyne also argues that Quanergy's proposed additions are based on a misapplication of claim differentiation and are confusing, illogical, and contradicted by its own expert. *Id*. at 8–10.

Quanergy argues that the proposed additions to claims 1 and 19 accurately reflect the recited function because claims 1 and 19 are independent claims, which much be broader than claim 8. Responsive Br. 10–12. The parties agree that the recited function of claim 8 is "rotating the support structure through a full 360 degree rotation at the rotation speed of at least 200 RPM" so, Quanergy argues, claims 1 and 19 must be broader and encompass less than a full 360 degree rotation. *Id*. Quanergy argues that its proposed construction does not add limitations, but simply reflects the full scope of claims 1 and 19. *Id*. at 10–11.

The Court agrees with Velodyne that the recited function is "rotat[e/ing] the plurality of laser emitters and the plurality of avalanche photodiode detectors at a speed of at least 200 RPM." First, this is the precise language that appears in the claims. Thus, adopting this construction best follows Federal Circuit law that "a court may not construe a means-plus-function limitation by adopting a function different from that explicitly recited in the claim." *JVW Enterprises*, 424 F.3d

at 1331 (citing *Micro Chem., Inc. v. Great Plains Chem. Co.*, 194 F.3d 1250, 1258 (Fed. Cir. 1999) ("The statute does not permit limitation of a means-plus-function claim by adopting a function different from that explicitly recited in the claim."). Second, although the Court agrees with Quanergy that independent claims 1 and 19 must be broader than dependent claim 8, Quanergy's alterations to the claim language are not necessary to accomplish this. Instead, simply leaving the claim language as-is—which is silent as to degree of rotation—leaves open that claims 1 and 19 can encompass any degree of rotation. Accordingly, given that Quanergy's additional language is unnecessary and Velodyne's proposed function tracks the claim language, the Court adopts Velodyne's proposed function.

ii. Claims 1, 8, and 19: Structure

Velodyne argues that the corresponding structure for the recited functions of claims 1, 8, and 19 is a "motor and equivalents." Opening Br. 10. Velodyne argues that this is supported by the specification, which discloses a "spin motor," '558 patent, Fig. 9A, and a "magnetic rotor . . . and stator," *id.*, 6:61. Opening Br. 10–11. Velodyne also argues that this is supported by the prosecution history, as Velodyne included a "rotary motor" in original claim 12 and argued in a response to an office action that the "motor [is] capable of producing a 200 RPM rate." *Id*. at 10–11. In contrast, Velodyne argues, Quanergy's proposed structure is too narrow because it is based on a preferred embodiment. *Id*. at 11–12. Velodyne also argues that Quanergy's use of "controller" is incorrect because it confuses what "might be needed to enable the pertinent structure to operate as intended [a motor controller] with [the] structure that actually performs the recited function [a motor]." *Visteon Glob. Techs., Inc. v. Garmin Int'l, Inc.*, No. 2:10-cv-10578-PDB-MAR, 2011 WL 13103572, at *18 (E.D. Mich. May 2, 2011) (citing *Asyst*, 268 F.3d at 1370).

Quanergy argues that its proposed construction is correct because, other than a reference to a "spin motor" in figure 9A, the only structure disclosed in the specification is that "[a] simple DC motor controller driving a high reliability brushed motor controls the rotation of the emitter/detectors." Responsive Br. 12–13; '558 patent, 5:39–40. Quanergy points out that other

parts of the specification—such as its disclosure of "220 HP brushless motors for brake and steering," '558 patent, 5:58—make clear that the inventor was aware of other types of motors, could have chosen to disclose these in the specification, but deliberately chose not to. Responsive Br. 12. Quanergy also argues that, from a technical perspective, a DC motor is required because other types of motors could not achieve the at least 200 RPM rotation. *Id*. at 12.

The Court finds neither party's position compelling. "Identification of corresponding structure may embrace more than the preferred embodiment. A means-plus-function claim encompasses all structure in the specification corresponding to that element and equivalent structures." *Micro Chem.*, 194 F.3d at 1258. Thus, the corresponding structure for "rotary component" must be all of the structures disclosed in the specification and their equivalents. The specification explicitly discloses three structures: the "brushed motor" which is "driv[en]" by "[a] simple DC motor controller," '558 patent, 5:39–40; the "spin motor," *id*., Fig. 9A; and "[t]he magnetic rotor and stator," *id*., 6:61. Thus, "rotary component" at least encompasses these three structures.

In light of this, Quanergy's position is too narrow. It identifies only one structure when, as discussed above, the specification identifies three. At the same time, however, Velodyne's position is too broad. "Motor and equivalents" would encompass much more than the structures disclosed in the specification, and thus does not conform to the balance struck by Congress in enacting § 112, ¶ 6. *See Williamson*, 792 F.3d at 1347 ("In enacting [§ 112, ¶ 6], Congress struck a balance in allowing patentees to express a claim limitation by reciting a function to be performed rather than by reciting structure for performing that function, while placing specific constraints on how such a limitation is to be construed, namely, by restricting the scope of coverage to only the structure, materials, or acts described in the specification as corresponding to the claimed function and equivalents thereof."). Thus, the Court finds that the appropriate corresponding structure for "rotary function" is a compromise between the two: a "brushed motor" which is "driv[en]" by "[a] simple DC motor controller;" a "spin motor;" a "magnetic rotor and stator;" and equivalents thereof.

iii. Invalidity

Quanergy argues that the claims are invalid because what it contends is the disclosed structure—the "brush motor"—is not capable of performing the recited function. Responsive Br. 13. It argues this is so because, according to its expert, the disclosed brush motor "cannot go back and forth at an angular rate equivalent to a rotation rate of at least 200 RPM." Kammerman Decl. ¶ 38, Dkt. No. 62. This argument assumes Quanergy's proposed constructions for both recited function and corresponding structure. Because the Court has rejected these positions and Quanergy makes no invalidity arguments based on any alternate construction, the Court declines to find that the claims are invalid.

C. "3-D point cloud" (claims 1 and 19)

Velodyne's Proposed Construction	Quanergy's Proposed Construction	Court's Construction
"a collection of distance measurements along sequentially varied directions emitted and captured in rapid succession that can be rendered as a three-dimensional image or analyzed for other reasons such as detecting obstacles"	No construction necessary, because the preamble is not limiting. To the extent the Court finds the preamble is limiting: "a collection of points in a 3-dimensional coordinate space"	"a collection of distance measurements along sequentially varied directions emitted and captured in rapid succession that can be rendered as a three-dimensional image or analyzed for other reasons such as detecting obstacles"

The term "3-D point cloud" appears in claims 1 and 19. These claims recite:

1. A lidar-based *3-D point cloud* system comprising:
   a support structure;
   a plurality of laser emitters supported by the support structure;
   a plurality of avalanche photodiode detectors supported by the support structure; and
   a rotary component configured to rotate the plurality of laser emitters and the plurality of avalanche photodiode detectors at a speed of at least 200 RPM.

19. A method of generating a *3-D point cloud* comprising:
   providing a lidar system having:
      a support structure, a plurality of laser emitters supported by the support structure;
      a plurality of avalanche photodiode detectors supported by the support structure, and a rotary component configured to rotate the plurality of laser emitters and the
      plurality of avalanche photodiode detectors at a speed of at least 200 RPM;
      rotating the plurality of laser emitters and the plurality of avalanche photodiode detectors at a speed of at least 200 RPM; and
      emitting light from the plurality of laser emitters.

'558 patent, 7:59–67, 9:6–17 (emphasis added).

Velodyne argues that the term "3-D point cloud" should be construed to mean "a collection of distance measurements along sequentially varied directions emitted and captured in rapid succession that can be rendered as a three-dimensional image or analyzed for other reasons such as detecting obstacles." Opening Br. 12. It argues that this language is taken directly from the specification. *Id*. It also argues that Quanergy's proposed construction is too broad because it could encompass a collection of two-dimensional points in a three-dimensional space. *Id*.

Quanergy takes the primary position that no construction of "3-D point cloud" is necessary. Responsive Br. 8. It argues, though, that should the Court find it necessary to construe this phrase, it should be construed to mean "a collection of points in a 3-dimensional coordinate space." *Id*. at 8. Quanergy argues that Velodyne's proposed construction is unnecessarily complicated and contrary to what a person of ordinary skill in the art would understand this term to mean. *Id*. at 8–9.

"'Claim construction' is for the purpose of explaining and defining terms in the claims . . . ." *Abbott Labs. v. Sandoz, Inc.*, 544 F.3d 1341, 1360 (Fed. Cir. 2008). Here, the Court finds that a construction of "3-D point cloud" would be helpful to a lay jury, as it is a technical term whose meaning is not "immediately apparent." *Phillips*, 415 F.3d at 1314. Thus, the Court will proceed to construe this term.

Interpreting "3-D point cloud" in the context of the entire patent, the Court agrees with Velodyne's proposed construction. The specification states that:

> When multiple pulses are emitted in rapid succession, and the direction of those emissions is somehow sequentially varied, each distance measurement can be considered a pixel, and a collection of pixels emitted and captured in rapid succession (called a "point cloud") can be rendered as an image or analyzed for other reasons such as detecting obstacles.

'558 patent, 1:19–24. Thus, the specification clearly defines "point cloud" as "a collection of pixels emitted and captured in rapid succession," where a "pixel" is a "distance measurement." *Id*. "[A] definition of a claim term in the specification will prevail over a term's ordinary meaning if the patentee has acted as his own lexicographer and clearly set forth a different definition." *3M*

Innovative Properties Co. v. Avery Dennison Corp., 350 F.3d 1365, 1371 (Fed. Cir. 2003). Thus, "point cloud" should be restricted to the specification's explicit definition.

The question then becomes how this definition should be adjusted to reflect the proper scope of "3-D point cloud." The Court finds that Velodyne's proposed construction is an accurate re-phrasing of the remaining portion of the above-quoted excerpt, which generally explains what a 3-D point cloud is. *See generally* '558 patent, 1:19–31. It is also not unnecessarily restrictive. As such, the Court adopts Velodyne's proposed construction, as it is an adequate explanation of "3-D point cloud" that would be helpful to a lay jury.

D. "A plurality of laser emitters" (claims 1 and 19)

Velodyne's Proposed Construction	Quanergy's Proposed Construction	Court's Construction
"two or more laser emitters"	"two or more light sources that generate laser beams, or a single light source that generates a single laser beam that is sub-divided into two or more smaller beams"	"two or more light sources that generate laser beams, or a single light source that generates a single laser beam that is sub-divided into two or more smaller beams"

The phrase "a plurality of laser emitters" appears in claims 1 and 19. These claims recite:

> 1. A lidar-based 3-D point cloud system comprising:
> a support structure;
> a *plurality of laser emitters* supported by the support structure;
> a plurality of avalanche photodiode detectors supported by the support structure; and
> a rotary component configured to rotate the plurality of laser emitters and the plurality of avalanche photodiode detectors at a speed of at least 200 RPM.
>
> 19. A method of generating a 3-D point cloud comprising:
> providing a lidar system having:
> a support structure, a *plurality of laser emitters* supported by the support structure;
> a plurality of avalanche photodiode detectors supported by the support structure, and a rotary component configured to rotate the plurality of laser emitters and the
> plurality of avalanche photodiode detectors at a speed of at least 200 RPM;
> rotating the *plurality of laser emitters* and the plurality of avalanche photodiode detectors at a speed of at least 200 RPM; and
> emitting light from the plurality of laser emitters.

'558 patent, 7:59–67, 9:6–17 (emphasis added).

Velodyne argues that this phrase should be construed to mean "two or more laser emitters"

because "plurality" simply means "two or more" and the words "laser emitters" are readily understandable to a jury and require no further construction. Opening Br. 13–14. Velodyne argues that Quanergy's proposed construction should be rejected because it improperly seeks to include mirrors, prisms, or other devices that split a laser beam within the meaning of "laser emitter." *Id*.

Quanergy, on the other hand, argues that its proposed construction is correct precisely because it includes mirrors, prisms, or other devices that split a laser beam. Responsive Br. 13–14. According to Quanergy, the specification discloses two embodiments of "laser emitters:" in one, each "laser emitter" is a physical diode, '558 patent, 4:59–63; in another, each laser beam is sub-divided into a smaller beam, *id*., 5:1–4. Responsive Br. 13–14. Thus, Quanergy argues, "laser emitter" should be construed to cover both embodiments. *Id*.

The Court agrees with Quanergy. The specification is clear that "emitter[s]" includes a single beam that is sub-divided. '558 patent, 5:1–4 ("Conversely, one could also sub-divide a single laser beam into several smaller beams. Each beam would be focused onto its own detector. In any event, *such systems are still considered emitter-detector pairs*.") (emphasis added). Quanergy's proposed construction includes this embodiment, whereas Velodyne's omits it. A construction that excludes a preferred embodiment is "rarely, if ever, correct." *Victronics*, 90 F.3d at 1583. Thus, the Court adopts Quanergy's position.

E. "Rotary power coupling" (claim 2)

Velodyne's Proposed Construction	Quanergy's Proposed Construction	Court's Construction
This term is not governed by 35 U.S.C. § 112 ¶ 6. No construction is necessary but, if a construction of "rotary power coupling" is necessary, then: "a power coupling that provides power to a rotating structure." The remaining portion of this claim term ("configured to	This term is governed by 35 U.S.C. § 112 ¶ 6 (pre-AIA), and should be construed as follows: Function: providing power from an external source to the plurality of laser emitters and the plurality of avalanche photodiode detectors	This term is not governed by 35 U.S.C. § 112 ¶ 6. "rotary power coupling" is construed as "a power coupling that provides power to a rotating structure"

provide power from an external source to the plurality of laser emitters and the plurality of avalanche photodiode detectors") does not require a construction.	Corresponding structure: a three-conductor rotary electrical connector with a liquid metal conductor.	

The term "rotary power coupling" appears in claim 2. Claim 2 recites:

> 2. The system of claim 1, further comprising a *rotary power coupling* configured to provide power from an external source to the plurality of laser emitters and the plurality of avalanche photodiode detectors.

'558 patent, 8:1–4 (emphasis added).

Velodyne argues that this term does not require construction because it is readily understandable to a jury. Opening Br. 14. Velodyne also argues in the alternative that, to the extent this term requires construction, it should be construed to mean "a power coupling that provides power to a rotating structure." *Id.* Velodyne argues that this is consistent with the intrinsic record and extrinsic evidence. *Id.* Velodyne disagrees that "rotary power coupling" is a means-plus-function term, arguing that "rotary power coupling" is a structural term which the patent and extrinsic evidence confirm refers to a discrete class of structures. *Id.* at 14–16.

Quanergy, on the other hand, argues that "rotary power coupling" is a means plus function term because a person of ordinary skill in the art would not understand this term to connote definite structure. Responsive Br. 14–16. As support, Quanergy cites to several dictionary definitions of "coupling" which, according to Quanergy, define this term by the function it performs (i.e., energy transfer) and nonce words. *Id.* at 14. Quanergy then argues that, in construing "rotary power coupling" under § 112, ¶ 6, the function of this term should be "providing power from an external source to the plurality of laser emitters and the plurality of avalanche photodiode detectors" and its structure should be a Mercotac Model 305, which is the only structure disclosed for this function in the specification. *Id.* at 16.

As an initial matter, the Court disagrees with Velodyne that "rotary power coupling" does not require construction. This is a technical term whose meaning would not be "readily apparent" to a lay jury. *Phillips*, 415 F.3d at 1314; *compare, e.g., Summit 6, LLC v. Samsung Elecs. Co.*, 802 F.3d 1283, 1291 (Fed. Cir. 2015) (district court did not err in declining to construe "[b]eing

provided to" because it "is comprised of commonly used terms; each is used in common parlance and has no special meaning in the art."). Thus, the Court will proceed to construe this term.

The question then becomes whether "rotary power coupling" is subject to 35 U.S.C. § 112, ¶ 6. As the Federal Circuit has instructed, if a claim uses the word "means," there is a rebuttable presumption that § 112, ¶ 6 applies, and, if the claim does not use the word "means," there is a rebuttable presumption that § 112, ¶ 6 does not apply. *Williamson*, 792 F.3d at 1348. However, even if a claim does not use the word "means," the presumption can be overcome if "the claim term fails to 'recite[] sufficiently definite structure' or else recites 'function without reciting sufficient structure for performing that function.'" *Id.* (quoting *Watts v. XL Sys., Inc.*, 232 F.3d 877, 880 (Fed. Cir. 2000)). The claims at issue here do not use the word "means." However, Quanergy nevertheless argues that § 112, ¶ 6 applies because technical dictionaries and Velodyne's proposed construction define "coupling" or "rotary power coupling" by the function it performs. Responsive Br. 14–16. Velodyne responds that § 112, ¶ 6 does not apply because "rotary power coupling" is a structural component and, given the requirement that it is "configured to provide power from an external source to the plurality of laser emitters and the plurality of avalanche photodiode detector," a person of ordinary skill in the art would know the discrete class of structures to which it corresponds. Opening Br. 14–15.

The Court agrees with Velodyne. In determining whether a party has overcome the presumption that § 112, ¶ 6 does not apply, the Federal Circuit directs the Court to "ask if the claim language, read in light of the specification, recites sufficiently definite structure to avoid § 112, ¶ 6." *Media Rights Techs.*, 800 F.3d at 1372. "The question is whether the claim language names particular structures or, instead, refers only to a general category of whatever may perform specified functions." *Robert Bosch, LLC v. Snap-On Inc.*, 769 F.3d 1094, 1099 (Fed. Cir. 2014).[3] This case involves the former. Reading claim 2 in light of the specification, it is clear that "rotary

[3] *Robert Bosch*, 769 F.3d at 1094, was decided before *Williamson*. However, *Media Rights Techs.*, a case which followed *Williamson*, cited *Robert Bosch* approvingly in explaining how courts should conduct the § 112, ¶ 6 inquiry post-*Williamson*. *Media Rights Techs.*, 800 F.3d at 1372.

power coupling" corresponds to a discrete class of structures. The specification describes in both text and figures how the "rotary power coupling" (or, as referred to there, "rotary coupling") structurally connects with other components in the system, and how these components interact:

> A rotary coupling 161, such as a three-conductor Mercotac model 305, *passes through the center* of the section 158 and the rotor 159. The *three conductors facilitated by the rotary coupling* are power, signal, and ground. A bearing 162 *mounts on the rotary coupling 161*. A rotary encoder 163 has one part *mounted on the rotary coupling 161* and another part mounted on the base section 158 of the housing 152. The rotary encoder 163, such as a U.S. Digital Model number E6s-1000-750-T-PKG1 provides information regarding to rotary position of the housing 152. The magnetic rotor 159 and stator 160 cause rotary motion of the base section 158 and thus the housing 152 *about the rotary coupling 161*.

'558 patent, 6:51–63 (emphasis added); *see also id*., Fig. 15 (showing rotary coupling 161). It also discloses a physical example of a "rotary coupling:" "a three-conductor Mercotac model." *Id*., 6:52. This provides sufficient structural detail such that "rotary power coupling" is not simply a "black box recitation of structure for providing the same specified function as if the term 'means' had been used." *Williamson*, 792 F.3d at 1350; *compare id*. (finding that § 112, ¶ 6 applies where "the claim does not describe how the 'distributed learning control module' interacts with other components in the distributed learning control server in a way that might inform the structural character of the limitation-in-question or otherwise impart structure to the 'distributed learning control module' as recited in the claim.").

Extrinsic evidence also makes it clear that "rotary power coupling" is not a means-plus-function term. As the dictionary definitions cited by Quanergy suggest, "coupling" implies some connection such that there is energy transfer. *See* Decl. of Gary Kamerman, Dkt. No. 62, Ex. B at 151 ("device which serves to join, link, or allow the transfer of energy"); Decl. of Gary Kamerman, Dkt. No. 62, Ex. D at 71 ("[a]ny means whereby power can be transferred from one circuit to another"); Decl. of Gary Kamerman, Dkt. No. 62, Ex. E at 124 ("[a] mutual relation between two circuits that permits energy transfer from one to another, through a wire, resistor, transformer, capacitor, or other device"). This sets out a broad class of structures, but it is structure nonetheless. This distinguishes this case from *Williamson*, where there was a made-up name for a black box software module. Instead, here, "coupling" is an electrical component,

which implies discrete structure. Thus, for this reason as well, "rotary power coupling" does not trigger § 112, ¶ 6.

F. "The plurality of photon detectors" (claim 3)

Velodyne's Proposed Construction	Quanergy's Proposed Construction	Court's Construction
"the plurality of avalanche photodiode detectors"	Indefinite under 35 U.S.C. § 112 ¶ 2 (pre-AIA).	"the plurality of avalanche photodiode detectors"

The phrase "the plurality of photon detectors" appears in claim 3. Claim 3 recites:

> 3. The system of claim 1, wherein each one of the plurality of laser emitters is paired with a separate one of the plurality of photon detectors in a fixed position to form a plurality of pairs of laser emitters and avalanche photodiode detectors.

'558 patent, 8:5–8 (emphasis added).

Velodyne argues that this phrase should be construed to mean "the plurality of avalanche photodiode detectors." Opening Br. 17–18. It argues that the claim language and prosecution history make it clear that "photon detectors" was intended to refer to "avalanche photodiode detectors." *Id*. It argues that, at worst, there was a minor oversight during prosecution where "photon detectors" was replaced with "avalanche photodiode detectors" in other pending claims and the applicant inadvertently failed to do this here. *Id*. Velodyne argues that Federal Circuit law permits the Court to correct this mistake, and that it should do so. *Id*.

Quanergy argues that this phrase renders claim 3 indefinite because it lacks antecedent basis. Responsive Br. 16–18. Quanergy argues that it is not clear that "photon detectors" was intended to refer to "avalanche photodiode detectors" because the claim language uses both phrases, and it is not clear from the prosecution history that the applicant intended "photon detectors" to be "avalanche photodiode detectors." *Id*.

"It is well-settled law that, in a patent infringement suit, a district court may correct an obvious error in a patent claim." *CBT Flint Partners, LLC v. Return Path, Inc.*, 654 F.3d 1353, 1358 (Fed. Cir. 2011). "A district court can correct a patent only if (1) the correction is not subject to reasonable debate based on consideration of the claim language and the specification and (2) the prosecution history does not suggest a different interpretation of the claims." *Id*. (quoting *Novo*

Industries L.P. v. Micro Molds Corp., 350 F.3d 1348, 1357 (Fed. Cir. 2003)). This inquiry should be conducted "from the point of view of one skilled in the art." *Ultimax Cement Manufacturing Corp. v. CTS Cement Manufacturing Corp.*, 587 F.3d 1339, 1353 (Fed. Cir. 2009).

Here, Velodyne's proposed construction is not subject to reasonable debate. The phrase "the plurality of photon detectors" appears in a claim that otherwise consistently refers to "the plurality of avalanche photodiode detectors."[4] Moreover, after claim 3 recites that "the plurality of laser emitters is paired with a separate one of the plurality of photon detectors," it immediately recites that this pairing "form[s] a plurality of pairs of laser emitters and avalanche photodiode detectors." '558 patent, 8:5–9. Reading this in context, it seems reasonable to infer that the "photon detectors" that get paired with the "laser emitters" are the same "avalanche photodiode detectors" in the "pairs of laser emitters and avalanche photodiode detectors." Accordingly, there can be no reasonable debate from the face of the claims that "the plurality of photon detectors" was intended to be "the plurality of avalanche photodiode detectors."

The prosecution history does not suggest a different interpretation of the claims. If anything, it confirms it. On January 31, 2011, Velodyne cancelled all of its pending claims which recited "photon detectors" and added new claims which—with the exception of pending claim 27 (current claim 3)—recited "avalanche photodiode detectors." Decl. of Brett M. Sanford, Dkt. No. 69, Ex. B at VEL00002871–77. In its remarks describing the newly added claims, Velodyne consistently referred to "avalanche photodiode detectors." *Id*. at VEL00002881–87. In describing pending claim 27 (current claim 3) specifically, Velodyne only referred to "avalanche photodiode detectors." *Id*. at VEL00002886 ("Claim 27 requires each of the APDs to be paired with a laser emitter. This pairing allows for faster and denser processing than has previously been possible with prior art devices."). Then, in making arguments distinguishing the prior art, Velodyne argued that one of the references, U.S Patent Application No. 2003/0090646 to Riegl, was distinguishable

[4] The Court reads claim 3 in conjunction with claim 1, from which it depends. Together, these claims contain multiple references to "the plurality of avalanche photodiode detectors" and only one reference to "photon detectors."

from the added claims because it only had one "avalanche photodiode detector" whereas the claims recited a "plurality." *Id*. at VEL00002883. Given all of this, it seems clear that Velodyne intended its newly added claims to consistently recite "avalanche photodiode detectors," not "photon detectors." As such, the use of "photon detectors" is plainly a drafting error.

Accordingly, the phase "the plurality of photon detectors" is replaced with "the plurality of avalanche photodiode detectors."

G. "A communication component configured to allow transmission of signals generated by the avalanche photodiode detectors to an external component" (claim 9)

Velodyne's Proposed Construction	Quanergy's Proposed Construction	Court's Construction
This term is governed by 35 U.S.C. § 112, ¶ 6. Function: allowing transmission of signals generated by the avalanche photodiode detectors to an external component. Corresponding structure: the structure identified at column 4, lines 34-36 and column 3, lines 25-27 (i.e., an Ethernet output (or similar output)" or "a rotary coupling device or a wireless communication device") and equivalents.	Indefinite under 35 U.S.C. § 112 ¶ 2 (pre-AIA). To the extent this term is found to not be indefinite, it is governed by 35 U.S.C. § 112 ¶ 6 (pre-AIA), and should be construed as follows: Function: allowing transmission of signals generated by the avalanche photodiode detectors to a component external to the system. Corresponding structure: Indefinite.	This term is governed by 35 U.S.C. § 112, ¶ 6. Function: allowing transmission of signals generated by the avalanche photodiode detectors to an external component. Corresponding structure: the structure identified at column 4, lines 34-36 and column 3, lines 25-27 (i.e., an "Ethernet output (or similar output)" or "a rotary coupling device or a wireless communication device") and equivalents.

The disputed phrase appears in claim 9. Claim 9 recites:

> 9. The system of claim 1, further comprising a *communication component configured to allow transmission of signals generated by the avalanche photodiode detectors to an external component*.

'558 patent, 8:33–36 (emphasis added).

The parties agree that the disputed phrase is governed by § 112, ¶ 6, but disagree as to its recited function and corresponding structure. The Court addresses each in turn.

i. Function

The parties disagree as to whether, in the recited function, the signals generated by the

APDs are transmitted "to an external component" (i.e., external to the APDs but not necessarily external to the LiDAR system) or "to a component external to the system" (i.e., external to the LiDAR system). Velodyne argues that the signals are transmitted "to an external component" because the plain language of the claim recites exactly this. Opening Br. 19–20. Quanergy, on the other hand, argues that reading claim 9 in the context of the specification makes clear that the signals are transmitted to a component that is external to the system, and its proposed version of the recited function merely clarifies that. Responsive Br. 18–19.

The Court agrees with Velodyne. "[A] court may not construe a means-plus-function limitation 'by adopting a function different from that explicitly recited in the claim.'" *JVW Enterprises*, 424 F.3d at 1331. The claim language explicitly recites "allowing transmission . . . to an external component" (Velodyne's proposal), not "allowing transmission . . . to a component external to the system" (Quanergy's proposal). Thus, Velodyne's proposed construction better conforms to Federal Circuit law.

Quanergy nevertheless contends that its narrower construction is warranted, as the specification makes clear that signals must be transmitted to a component that is external to the system. Responsive Br. 18–19. The Court disagrees. It is true that, in some places, the specification discloses communication to components external to the LiDAR system. *See, e.g.*, '558 patent, 5:16–18. However, it is not clear from the specification that the claims must be restricted to only this type of communication. In another section, the specification states that "[t]he data produced by each circuit is output to external components" but does not specifically clarify whether these "external components" are actually external to the LiDAR system. *Id.*, 5:67–6:1. Thus, this sentence could be interpreted as disclosing communication that is either external to the APDs or external to the LiDAR system. The Federal Circuit considers it "axiomatic that we will not narrow a claim term beyond its plain and ordinary meaning unless there is support for the limitation in the words of the claim, the specification, or the prosecution history." *Wasica Fin. GmbH v. Cont'l Auto. Sys., Inc.*, 853 F.3d 1272, 1281 (Fed. Cir. 2017) (quoting *3M Innovative Props. Co. v. Tredegar Corp.*, 725 F.3d 1315, 1333 (Fed. Cir. 2013)). Because it is not clear from

the intrinsic record that "external components" must be limited to components external to the LiDAR system, the Court will not restrict them in this way. As such, the Court agrees with Velodyne that "external component" refers to a component external to the APDs but not necessarily (but possibly) external to the LiDAR system and adopts its proposed recited function: "allowing transmission of signals generated by the avalanche photodiode detectors to an external component."

ii. Structure

Velodyne argues that the corresponding structure should be construed to be the structure identified at column 4, lines 34-36 and column 3, lines 25-27 (i.e., an "Ethernet output (or similar output)" or "a rotary coupling device or a wireless communication device") and equivalents. Opening Br. 20–21. Quanergy, on the other hand, argues that the specification does not disclose any corresponding structure because the claimed APDs generate an analog signal and the specification does not disclose any means of transmitting this analog signal. Responsive Br. 19–20. Instead, contends Quanergy, it only discloses means of transmitting digitized range and intensity data, which is generated from this analog signal. *Id.*

The Court agrees with Velodyne. Claim 9 recites that the transmitted signals are "generated by the avalanche photodiode detectors." '558 patent, 8:33–36. It does not, however, recite that the generated signals are "directly generated by the avalanche photodiode detectors," or that any intermediate processing of these signals is prohibited. *See id.* Moreover, reading this claim language in light of the specification makes clear that some intermediate processing of the transmitted signals is acceptable. For example, Figure 9A shows that the signal from the photodiode is first fed through an "8-bit A/D [analog to digital] Converter" before it is outputted as "signal out." *Id.*, Fig. 9A. Thus, the transmitted signals in claim 9 can include signals that are either directly (i.e., with no intermediate processing) or indirectly (i.e., with intermediate processing) "generated by the avalanche photodiode detectors." Accordingly, the Court rejects Quanergy's contention that claim 9 is invalid and instead adopts Velodyne's proposal that the corresponding structure is the structure identified at column 4, lines 34-36 and column 3, lines 25-

27 (i.e., an "Ethernet output (or similar output)" or "a rotary coupling device or a wireless communication device") and equivalents.

H. "Processor being configured to . . ." (claims 16–18 and 23–25)

Velodyne's Proposed Construction	Quanergy's Proposed Construction	Court's Construction
This term is not governed by 35 U.S.C. § 112, ¶ 6. No construction is necessary. [*See* Second Amended Joint Claim Construction and Prehearing Statement, Dkt. No. 66, for alternate proposed constructions under § 112, ¶ 6]	Indefinite under 35 U.S.C. § 112 ¶ 2 (pre-AIA). To the extent this term is found to not be indefinite, it is governed by 35 U.S.C. § 112 ¶ 6 (pre-AIA), and should be construed as follows: [*See* Second Amended Joint Claim Construction and Prehearing Statement, Dkt. No. 66, for alternate proposed constructions under § 112, ¶ 6]	This term is not governed by 35 U.S.C. § 112, ¶ 6. No construction is necessary.

The disputed phrases appear in claims 16–18 and 23–25. These claims recite:

> 16. The system of claim 1, further comprising a *processor* in signal communication with the plurality of avalanche photodiode detectors and the plurality of laser emitters, the processor being configured to cause the laser emitters to *emit pulses of a reduced power level* when at least one of the avalanche photodiode detectors detects a *return signal* above a *threshold level*.
>
> 17. The system of claim 1, further comprising a *processor* in signal communication with the plurality of laser emitters, the processor being configured to prevent the laser emitters from firing when the rotary component is not rotating.
>
> 18. The system of claim 1, further comprising a *processor* in signal communication with the plurality of laser emitters, the processor being configured to prevent the laser emitters from firing when the rotary component is rotating below a *threshold level*.
>
> 23. The method of claim 19, wherein the lidar system further comprises a *processor* in signal communication with the plurality of avalanche photodiode detectors and the plurality of laser emitters, the processor being configured to cause the laser emitters to *emit pulses of a reduced power level* when at least one of the avalanche photodiode detectors detects a *return signal* above a *threshold level*, the step of emitting light from the plurality of laser emitters further comprising causing the laser emitters to emit pulses of a *reduced power level* when at least one of the avalanche photodiode detectors detects a *return signal* above a *threshold level*.
>
> 24. The method of claim 19, wherein the lidar system further comprises a *processor*

in signal communication with the plurality of avalanche photodiode detectors and the plurality of laser emitters, the processor being configured to prevent the laser emitters from firing when the rotary component is not rotating, the step of emitting light from the plurality of laser emitters further comprising causing the laser emitters to emit light only when the rotary component is rotating.

25. The method of claim 19, wherein the lidar system further comprises a *processor* in signal communication with the plurality of avalanche photodiode detectors and the plurality of laser emitters, the processor being configured to control the firing of the laser emitters in relation to the rotation of the rotary component, the step of emitting light from the plurality of laser emitters further comprising causing the laser emitters to emit light only when the rotary component is rotating above a *threshold level*.

'558 patent, 8:57–9:5, 10:1–28 (emphasis added).

i. Claims 16 and 23: "threshold level," "return signal," "emit pulses of a reduced power level"

Quanergy argues that the terms "threshold level," "return signal," and "emit pulses of a reduced power level" render the claims indefinite because they fail, as required by *Nautilus*, 134 S. Ct. at 2124, to inform a person of ordinary skill in the art with reasonable certainty as to the scope of the claim. Responsive Br. 20. In particular, Quanergy argues that there is no indication as to how to establish a threshold level, how the return signal is measured, or how the emitted pulses are modified to reduce the power level. *Id*. Velodyne disagrees, arguing that the claims, read in light of the specification, provide sufficient clarity to a person of ordinary skill as to the meaning of these terms and how they define the scope of the claims. Reply Br. 12–14. The Court addresses each of the disputed phrases in turn.

Turning first to "threshold level," the Court agrees with Velodyne that this term does not render claims 16 and 23 indefinite. Claims 16 and 23 simply require that the "threshold level" is some set quantity which, when reached or exceeded, causes a reduction in the power level of the pulses emitted by the lasers. *See* '558 patent, 8:57–63, 10:1–11. This term need no further definition to reasonably inform a person of ordinary skill in the art as to the scope of the claims. *Nautilus*, 134 S. Ct. at 2124. Whether this threshold level is 5 or 500, the claims have definite boundaries, which encompass any logic where "detect[ing] a return signal above a threshold level" causes a "reduced power level." Thus, this term does not render claims 16 and 23 indefinite.

Turning next to "return signal," the Court also agrees with Velodyne that this term does

not render claims 16 and 23 indefinite. Claims 16 and 23 recite that the "return signal" is something which the "avalanche photodiode detectors detect[]" to be "above a threshold level." '558 patent, 8:57–63, 10:1–11. The specification further elaborates that the charging time for the laser diode is variable, and can be "determined by return intensity measurements from the last pulse." *Id*., 7:24. "For example, if the return pulse is ½ as large as desirable, from a noise and measurement accuracy point of view, then the DSP simply charges the inductor for twice as long for the next pulse." *Id*., 7:34–37. Thus, reading the claim language in light of the specification, it is clear that the "return signal" is simply the "return intensity measurements" that can be used to vary the charging time. *See id*. The range of methods for taking these measurements are finite and familiar to persons of ordinary skill in the art, and the specification need not further clarify this in order for that person to know the scope of the claims. Accordingly, "return signal" does not render the claims indefinite. *Nautilus*, 134 S. Ct. at 2124.

Turning finally to "emit pulses of a reduced power level," the Court also agrees with Velodyne that this term does not render claims 16 and 23 indefinite. What it means for a laser to "emit pulses of a reduced power level" is not an unfamiliar concept to a person of ordinary skill in the art, and the specification explains how the power level of the pulses get reduced:

> It can be seen that the energy stored in the inductor is ½*L*I^2. When the FET is turned off, this energy is transferred into the discharge capacitor via a diode. The energy in the capacitor is ½° C.*V^2. It is apparent then that the voltage that is in the capacitor is proportional to the on duration of the FET. Therefore, the DSP can use a simple algorithm to predict the proper amount of voltage in the capacitor. For example, if the return pulse is ½ as large as desirable, from a noise and measurement accuracy point of view, then the DSP simply charges the inductor for twice as long for the next pulse.

'558 patent, 7:27–37. Thus, "emit pulses of a reduced power level" does not prevent a person of ordinary skill in the art from being reasonably informed as to the scope of the claims. *Nautilus*, 134 S. Ct. at 2124. As such, claims 16 and 23 are not indefinite on this basis.

ii. Claims 16-18 and 23-25: "Processor" limitations

The parties next dispute whether "processor" invokes § 112, ¶ 6, and, if so, what its recited function and corresponding structure are. The Court addresses these issues in turn.

a. Whether the "processor" terms invoke § 112, ¶ 6

Velodyne argues that "processor" connotes sufficiently definite structure such that it does not invoke § 112, ¶ 6. Opening Br. 22–23. It contends that the claim language, specification, and extrinsic evidence from Quanergy's own patents supports this conclusion. *Id*. Quanergy, on the other hand, argues that "processor" invokes § 112, ¶ 6 because it is a "generic description for an undefined combination of software or hardware that performs the function of controlling the emissions of the laser emitters." Responsive Br. 20–22. Quanergy argues that even in light of all of the intrinsic and extrinsic evidence cited by Velodyne, the processor could be anything from transistor-transistor logic to a general purpose processor, which is not sufficient to connote sufficiently definite structure. *Id*.

As discussed above, if a claim uses the word "means," there is a rebuttable presumption that § 112, ¶ 6 applies, and, if the claim does not use the word "means," there is a rebuttable presumption that § 112, ¶ 6 does not apply. *Williamson*, 792 F.3d at 1348. Here, the claims at issue do not use "means;" thus, there is a rebuttable presumption that § 112, ¶ 6 does not apply.

However, even if a claim does not use the word "means," the presumption can be overcome if "the claim term fails to 'recite[] sufficiently definite structure' or else recites 'function without reciting sufficient structure for performing that function.'" *Id.* (quoting *Watts v. XL Sys., Inc.*, 232 F.3d 877, 880 (Fed. Cir. 2000)). Such is not the case here. Instead, construing the claim language in light of the specification makes clear that "processor" is a structural limitation. First, the plain language of the claims describes how the processor interacts with other components: "processor in signal communication with the plurality of avalanche photodiode detectors and the plurality of laser emitters" (cl. 16, 23–25), "processor in signal communication with the plurality of laser emitters" (cl. 17, 18). This "informs the processor's structural character." *Finjan, Inc., v. Proofpoint, Inc.*, No. 13-CV-05808-HSG, 2015 WL 7770208, at *11 (N.D. Cal. Dec. 3, 2015) (finding that § 112, ¶ 6 did not apply where the claim language "describes how the 'content processor' interacts with the invention's other components (the transmitter and receiver), which informs the term's structural character"). Second, the specification provides structural information

about the "processor," as it discloses the use of a DSP or processor to control the emitting and discusses its relation to other components in the system. *See, e.g.,* '558 patent, 7:18–41 (describing "circuits used for controlling the firing of a laser diode"), Fig. 9A (showing two Texas Instruments DSPs connected to other hardware components); *see also, e.g., id*. at 4:20–26, 5:11–15, 5:40–44, 5:64–67. Thus, reading the claims in light of the specification, the "processor" is not simply a "black box recitation of structure for providing the same specified function as if the term 'means' had been used." *Williamson*, 792 F.3d at 1350. Instead, "processor" refers to a specific class of structures. As such, "processor" is not a means-plus-function term invoking § 112, ¶ 6.

b. Construction of "processor"

Because the Court finds that "processor" does not invoke § 112, ¶ 6, it need not address the parties' competing proposals for structure and corresponding function. Rather, the Court agrees with Velodyne that "processor" requires no construction and should be given its plain and ordinary meaning.

IV. ORDER

For the reasons set forth above, the Court Construes the disputed terms as follows:

Claim Terms	Court's Construction
The Preambles: "A lidar-based 3-D point cloud system" (claim 1) and "A method of generating a 3-D point cloud" (claim 19)	Preamble is limiting
"Rotary component" (claims 1, 8, and 19)	This term is governed by 35 U.S.C. § 112 ¶ 6. Claims 1 and 19: Function: rotating the plurality of laser emitters and the plurality of avalanche photodiode detectors at a speed of at least 200 RPM. Corresponding structure: (1) the "brushed motor" which is "driv[en]" by "[a] simple DC motor controller," '558 patent, 5:39–40; (2) the "spin motor," *id*., Fig. 9A; (3) "[t]he magnetic rotor and stator," *id*., 6:61; and (4) equivalents. Claim 8: Function: rotating the support structure through a full 360 degree rotation at the rotation speed of at least 200 RPM.

	Corresponding structure: (1) the "brushed motor" which is "driv[en]" by "[a] simple DC motor controller," '558 patent, 5:39–40; (2) the "spin motor," *id*., Fig. 9A; (3) "[t]he magnetic rotor and stator," *id*., 6:61; and (4) equivalents.
"3-D point cloud" (claims 1 and 19)	"a collection of distance measurements along sequentially varied directions emitted and captured in rapid succession that can be rendered as a three-dimensional image or analyzed for other reasons such as detecting obstacles"
"A plurality of laser emitters" (claims 1 and 19)	"two or more light sources that generate laser beams, or a single light source that generates a single laser beam that is sub-divided into two or more smaller beams"
"Rotary power coupling" (claim 2)	This term is not governed by 35 U.S.C. § 112 ¶ 6. "rotary power coupling" is construed as "a power coupling that provides power to a rotating structure"
"The plurality of photon detectors" (claim 3)	"the plurality of avalanche photodiode detectors"
"A communication component configured to allow transmission of signals generated by the avalanche photodiode detectors to an external component" (claim 9)	This term is governed by 35 U.S.C. § 112, ¶ 6. Function: allowing transmission of signals generated by the avalanche photodiode detectors to an external component. Corresponding structure: the structure identified at column 4, lines 34-36 and column 3, lines 25-27 (i.e., an "Ethernet output (or similar output)" or "a rotary coupling device or a wireless communication device") and equivalents.
"Processor being configured to . . ." (claims 16-18 and 23-25)	This term is not governed by 35 U.S.C. § 112, ¶ 6. No construction is necessary.

IT IS SO ORDERED.

Dated: October 4, 2017

EDWARD J. DAVILA
United States District Judge